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CS3600 Project 4 Analysis

Q5: Learning with restarts

Pen Data Test:

- Max: 0.904230989137
- Average: 0.901229273871
- Standard Deviation: 0.00614175073159

Car Data Test:

- Max: 0.890052356021
- Average: 0.883507853403
- Standard Deviation: 0.00654973612733

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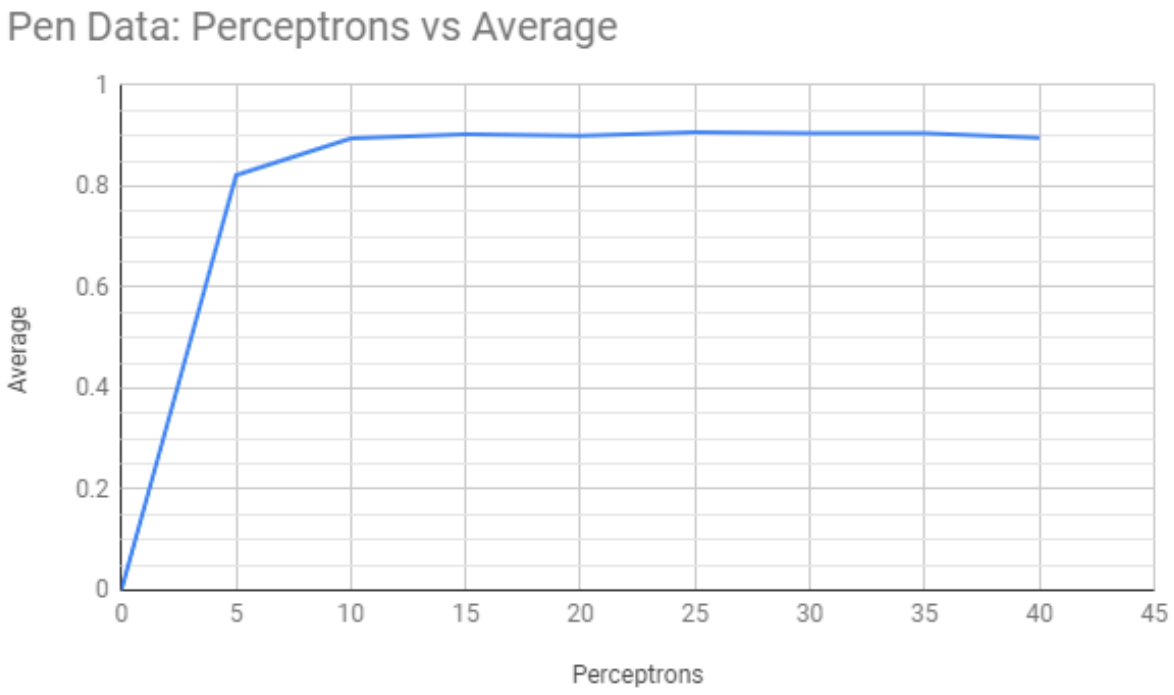
Q6: Varying the hidden layer

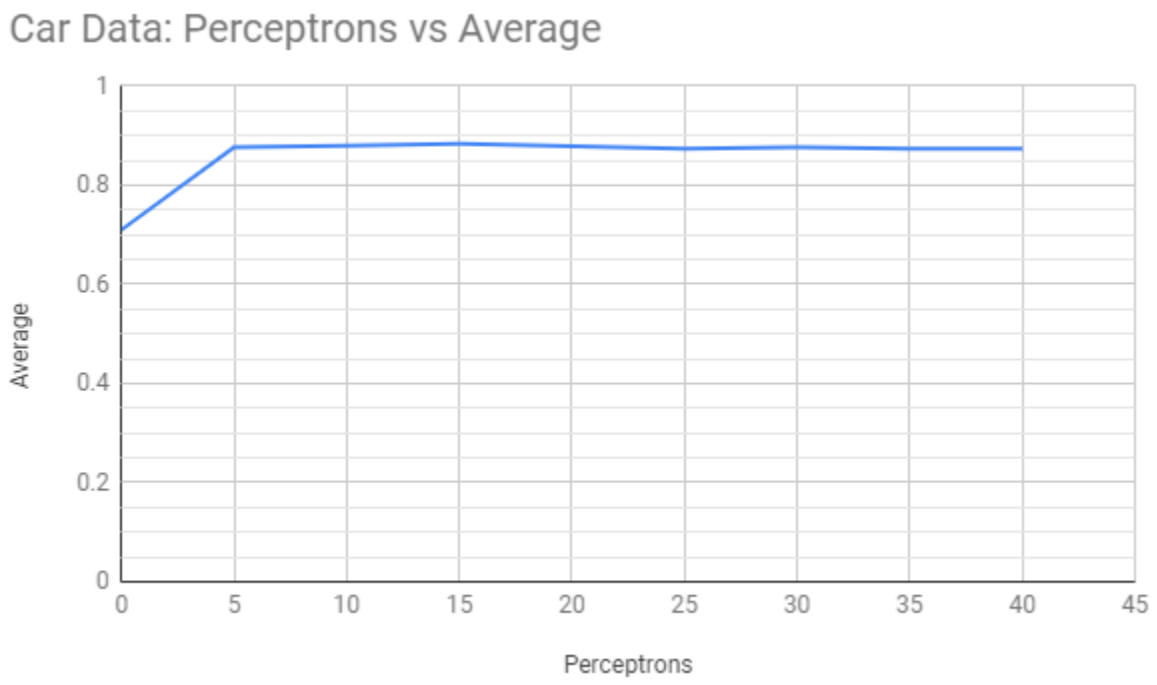
Pen Data

Perceptrons	Max	Average	Standard Deviation
0	0	0	0
5	0.8401943968	0.8213836478	0.0197990857
10	0.9053744997	0.8949113779	0.009819553775
15	0.9090909091	0.9028016009	0.005487063746
20	0.905946255	0.8995425958	0.00654054064
25	0.909948542	0.9068038879	0.002706039924
30	0.905946255	0.9050886221	0.0006765099809
35	0.9093767867	0.904974271	0.002211444209
40	0.9053744997	0.895997713	0.00720366285



Car Data

Perceptrons	Max	Average	Standard Deviation
0	0.710078534	0.710078534	0
5	0.8808900524	0.8768324607	0.003711373528
10	0.8926701571	0.8797120419	0.00786865883
15	0.8907068063	0.8839005236	0.004730186126
20	0.8808900524	0.8781413613	0.002996210247
25	0.8841623037	0.8732984293	0.007364819318
30	0.877617801	0.8763089005	0.00137278645
35	0.8795811518	0.8735602094	0.00529093794
40	0.8815445026	0.8731675393	0.004446410406



For both neural nets, accuracy greatly increases when the number of hidden layers is increased from zero to five. Accuracy for both data sets continue to increase until the number of hidden layers reach 15. After 15 hidden layers, the accuracy appears to stabilize around 0.905 for pen data and 0.876 for car data. As the number of hidden layers passes 30, there seems to be a small decrease in accuracy as the accuracy for the max number of hidden layers (40) is never the most accurate. It is also interesting that with zero perceptrons the accuracy for car data is around .70 but the neural net has not started learning yet.

Q7: Learning XOR

When the neural net was trained without a hidden layer, the average accuracy was 0.247 with a max accuracy of 0.5. The average accuracy decreases until the 7^{th} perceptron, to an average accuracy of 0.292857142857. As the number of perceptrons increases from here, the average accuracy starts increasing for the rests of the tests. 100% max accuracy is reached at 24 perceptrons with 5 iterations, 8 perceptrons with 400 iterations, and 2 perceptrons with 8000 iterations. The results are what I expected based on class material. As the number iterations increased, it takes less perceptrons to fully train the neural net.